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BIOMASS GASIFICATION BEHAVIOUR IN AN ENTRAINED FLOW REACTOR

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Biomass has a high potential among the renewable energy sources because the use of biomass for energy and chemicals leads to low net CO_2 emission [1]. The transportation sector represented about 21% of the world's primary energy consumption in 2000, and this share continues to increase [2]. Thus an important aspect of biomass utilization is to produce liquid fuels for transportation. Gasification is a thermochemical process currently available for syngas production, which can be subsequently used as raw material to synthesize liquid fuels in a catalytic process [3]. One of the key problems to be solved in liquid fuels from syngas is to control the syngas quality with respect to both the H_2/CO ratio and the harmful impurities. Compared with fixed-bed and fluidized-bed gasification, entrained flow gasification operates at higher temperature with smaller particles, often achieves a high carbon conversion, and produces a high quality syngas with low tar and methane content [4]. However, the utilization of biomass in entrained flow gasifier originally designed for coal is still unexploited, and thus a systematic study of biomass gasification in an entrained flow reactor is of great interest.

In the present study, a gasification system including a bench-scale atmospheric pressure entrained flow reactor and other auxiliary facilities was utilized. Effects of operating conditions and biomass type (wood and straw) on the solid and gas products were investigated. Biomass was completely converted in all experiments and the produced syngas without tar and methane but with soot as the main by-product. A reasonable carbon mass balance closure was achieved for all conditions. The H_2/CO molar ratio of the syngas is in the range of 0.8-1.1. Higher temperature, steam addition, relatively higher excess air ratio, longer residence time and increasing feeder air flow can effectively decrease the soot yield, while the inlet oxygen level seems not to influence the soot yield significantly. Wood and straw gasification provides similar gas composition. However, the soot yield was much lower in straw gasification than that in wood gasification possibly due to the high potassium content in straw, which may have a catalytic role on straw soot gasification.

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